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U. S. DEPARTMENT OF AGRICULTURE - FOREST SERVICE
PACIFIC SOUTHWEST FOREST AND RANGE EXPERIMENT STATION
Division of Forest Insect Research

AN APPRAISAL OF FIRE INJURY TO PONDEROSA PINE AT BROWN'S FLAT, SAN DIMAS EXPERIMENTAL FOREST, AUGUST 1960

INTRODUCTION

On July 21-23, fire swept the San Dimas Experimental Forest, destroying about 90 percent of the coniferous plantations at Tanbark Flat.1/ The fire also burned through a natural area of ponderosa pine on the Forest at Brown's Flat, but the damage to this stand was not determined at the time the Tanbark plantations were appraised. A special survey to assess this damage and to determine what steps could be taken to preserve the residual stand was conducted on August 11, 18, and 20. This survey was made by R. C. Hall, assisted by John R. Pierce, Technical Advisor for the southern California National Forests, and R. A. Entzminger, James Vande Weg., and Gary Hughes of the Mt. Baldy District, Angeles National Forest.

Brown's Flat is very unique ecologically. It contains remnants of a virgin ponderosa pine stand about 32 acres in extent, isolated by many miles from the nearest similar natural stand. The ponderosa pine occurs in two large groves and about 20 smaller groves interspersed with meadowland. Before the fire it was surrounded on all sides by a heavy stand of oak and other brush species (see map). The site appears to be excellent for tree growth and probably can be considered Site I. The dominant trees are nearly 200 feet in height and up to 72 inches d.b.h.

The area is one that seems to have considerable recreational and research possibilities. Prior to the fire it was accessible only by foot trail, but thereafter it became accessible by jeep or other four-wheel equipment, along a steep firebreak.

SURVEY METHODS

A 100 percent cruise of the ponderosa pine in the Brown's Flat area was made to assess the tree mortality due to the fire, classify the remaining trees according to their expected chances of survival, and determine the extent of insect infestations present. Altogether 222 of the trees were numbered with paint. Diameter at breast-height was measured on each tree, and on

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1/ Hall, R. C. and Wagener, W. W. An appraisal of fire injury to coniferous plantations on the San Dimas Experimental Forest, July 1960. U. S. Forest Serv. Pac. Southwest Forest and Range Expt. Sta. 8 pp., illus. August 12, 1960. (processed)

selected trees the height was measured with an Abney level and tape. Limited data were also collected on diameter growth from a series of trees which had been cut in the fire-suppression program.

The extent of foliage, bud and cambium injury on trees over 20 inches in diameter was estimated. Estimates were also made of the percent of green crown and percent of the trunk scorched by the fire, and of the extent of basal fire scars. Each tree was then classified on the basis of its expected chances of survival. Class 1 was for trees given a very good chance of recovery in the absence of attacks by primary bark beetles. Class 2 included those where the chance of recovery from the effects of fire alone was considered doubtful. In Class 3 were placed trees considered to have a very poor chance of recovery. Trees of this type were also expected to be highly susceptible to attacks by primary bark beetles. Class 4 included trees on which the crown was completely scorched, as well as those with the crown completely burned off. Trees in this category were considered to be dead at the time they were classified. The scorched trees, however, may be highly susceptible to bark beetles on the basis of past experience. Those with the crown burned off, should present no hazard from this standpoint.

RESULTS

The survey showed that the Brown's Flat area contained 289 ponderosa pine trees with a total estimated volume of 843,170 board feet (table 1). The trees ranged in diameter from 12 to 72 inches d.b.h.; the average being about 40 inches. The range in height of the dominant trees was 150 to 195 feet, and the average height about 172 feet. Growth measurements showed that radial growth has been rapid; some trees have increased in diameter by more than ½ inch per year (table 2). One 33-inch diameter tree, for example, was found to be only 61-years old; another 41-inch diameter tree was only 70-years old. The oldest tree measured was 530-years old at about 10 feet above the ground. This particular tree had burned off at the groundline.

The distribution of the trees by survival classes is shown in table 3. These data reveal that over 25 percent of the total volume and nearly 42 percent of the total number of trees present were dead, mostly from the effects of the fire. Of the surviving trees, the smallest number as well as the smallest volume was in Class 2. The number of trees in Classes 1 and 3 was about equal, but the volume in Class 1 was more than half again as much as in Class 3, probably because the larger trees were better able to withstand the fire. From the data in table 4, the average percent of green crown on the surviving trees was calculated to be as follows:

Class 1	77.8 percent
Class 2	40.7 "
Class 3	15.8 "

The survey showed that the primary bark beetles generally associated with ponderosa pine were present at Brown's Flat. The western pine beetle, Dendroctonus brevicomis Lec., and the red turpentine beetle, D. valens Lec., were found, and evidence of the work of the California flatheaded

borer, Melanophila californica Van D., and a bark beetle believed to be the California five-spined ips, Ips confusus (Lec.) was also found. Two trees (nos. 27 and 150) were currently infested with the western pine beetle and the red turpentine beetle. The red turpentine beetle also was present in tree number 196. This tree was suspected of being infested with the western pine beetle, although this could not be confirmed. Several trees cut in fire suppression had been attacked by a combination of the western pine beetle, ips, and roundheaded borers. Practically all of the fire-killed trees under 12 inches in diameter were heavily infested with flatheaded borers, and many of the larger trees with serious cambium damage also had been attacked by these insects.

Discussion

Much of the ponderosa pine remaining in the Brown's Flat area has been injured to the point where it is susceptible to bark beetles. Damage from these insects is anticipated unless prompt corrective action is taken. Past experience on similar burns in ponderosa pine stands has shown that the western pine beetle and the red turpentine beetle can build up very rapidly in trees seriously injured by fire. To help avert this, the Station took steps as soon as this survey was completed to spray by helicopter 78 trees with a 1.0 percent water emulsion of lindane.

The distribution of the treated trees by survival classes was as follows: Class 1-50; Class 2-1; Class 3-21; and Class 4-4. One currently infested and 1 recently abandoned tree also were sprayed. Tree nos. 1 through 65 were sprayed groupwise at an average of about 10 gallons per tree. In spraying tree nos. 94, 95, 96, 97, 105 and 106, the helicopter hovered over each tree at nearly tree-top height and applied about 15 gallons per tree. Tree nos. 66, 70, 76, 79, 84, 95 and 96 were sprayed by free-dropping 30 gallons per tree from a plastic bag. This operation was strictly a "shot in the dark" and what effect it will have in preventing a bark beetle buildup remains to be seen.

There are two other courses of action open which could be expected to reduce the potential for bark beetle damage to the residual stand. One of these is to log immediately all of the seriously injured trees. The other is to fell and treat all of the currently infested trees, and any others that become infested as they show up.

Logging the seriously injured trees would mean cutting all those in Class 3. This class contains 77 trees with a total volume of 220,080 board feet. If the fire-killed and insect-infested material is added to this, the total number of trees to be cut is 198, and the total volume 438,200 board feet. This approach would remove all the ponderosa pine most susceptible to bark beetles. It has the disadvantage of eliminating some trees which conceivably might survive, since we cannot say categorically that every tree placed in Class 3 will succumb to beetle attack. To log Brown's Flat would necessitate constructing 1½ miles of access road into the area through steep ground. The effect of this construction on watershed management research in progress at San Dimas is another consideration to be taken into account.

As opposed to logging, direct control would necessitate felling and spraying with insecticides the three trees found to be infested at the time of this survey; and any others that become infested later. The insecticide recommended is ethylene dibromide. This should be applied before the beetles mature and emerge. Since the current objective of insect control on the San Dimas Experimental Forest is to save every tree not already dead, from subsequent death by insects, this approach appears to be preferable to logging. It is suggested that a control program at Brown's Flat be set up on a year-round maintenance basis. The area should be systematically spotted at about 2-month intervals from April to October, and all infested trees should be treated before the beetles emerge.

Ralph C. Hall

November 1, 1960
Berkeley, Calif.

Ralph C. Hall,
Entomologist

Attachments: Map
Tables 1-4

Table 1.--Number of ponderosa pine trees at Brown's Flat by diameter and survival classes

Diameter	Class 1	Class 2	Class 3	Class 4 1/	Insect-infested	All
Inches						
12	5		5	1		11
14	1		2	2		5
16	2		2	3		7
18	2		2	12		16
20	3		7	9		19
22	3		3	12		18
24	4	1	8	9		22
26	5		4	14		23
28	4		2	9		15
30	1		4	7		12
32	2		1	9		12
34	2		4	7	1	14
36	2	1	5	11		19
38	4	1	1	1	1	8
40	3		5	1		9
42	7		4			11
44	4		1	1		6
46	2		2	3		7
48	5		2			7
50	3		4			7
52	6	1	3	1		11
54	1		0	2		3
56	2		2	2		6
58	3		1			4
60	0	2	1			3
62	5		1	1		7
64	0		0			0
66	1				1	2
68	0			1		1
70	1					1
72	1	1	1			3
Total no. trees	84	7	77	118	3	289
Diameter of ave. tree(in.)	43	52	37	32	49	38

1/ Class 4 trees include 56 cut as part of fire-suppression operation.

Table 2.--Diameter growth on ponderosa pine trees cut in fire-suppression, Brown's Flat

Stump diameter	Age	Average diameter growth per year	Average number rings per inch
Inches		Inches	Inch-radius
33	61	0.54	3.7
16	40	0.40	5.0
42	118	0.36	5.6
28	120	0.23	8.5
42	107	0.39	5.1
41	70	0.57	3.4
72	530	0.14	14.7

Table 3.--Stand and volume data, based on 100 percent cruise of ponderosa pine, Brown's Flat

Survival class	Trees		Volume	
	Number	Percent	Board feet	Percent
1	84	29.1	354,940	42.1
2	7	2.4	50,030	5.9
3	77	26.6	220,080	26.1
4 (fire-killed)	118	40.8	199,960	23.7
(insect-killed)	3	1.1	18,160	2.2
Total	289	100.0	843,170	100.0

Table 4.--Number of trees by percent of green crown and survival classes,1/ Brown's Flat

Percent of green crown	Class 1	Class 2	Class 3
0			1
2			18
5			15
10			12
15			9
20			4
25	1	1	7
30		1	0
40	3	3	0
50	6	1	6
60	6	1	5
70	12		
80	24		
90	23		
100	9		
Total	84	7	77

1/ Class 4 trees had no green foliage.

BROWNS FLAT
San Dimas Experimental Forest
Timber Type Map

Ponderosa pine

Scale: 16" = 1 mile